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Title: Observed Compliance with Safe Sleeping Guidelines in Licensed Childcare Services

Short Title: Compliance with Safe Sleeping Guidelines in Childcare

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Contributors' Statement

Dr Staton and Prof Thorpe led the research team, oversight of observational data collections, analyses and writing of the paper.

Associate Professor Smith and Dr Pattinson contributed to data collections and analyses and reviewed and revised the manuscript.

Dr Blair, Professor Young, Dr Pease and Associate Professor Irvine, contributed to analysis and reviewed and revised the manuscript.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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ABSTRACT

Objective: To independently assess compliance with safe sleeping guidelines for infants <12 months in licensed childcare services.

Design: Full-day, *in-situ* observations of childcare practices (including sleep and non-sleep periods) conducted in 2016-2017.

Setting: Australian home- and centre-based licensed childcare services. All subject to national regulation and legislation to comply with safe sleeping guidelines.

Participants: The sample was 18 licensed childcare settings (15 centre-based, 3 home-based) that had infants <12 months ($n=49$) attending at the time of observation. 31 educators completed self-report surveys.

Main Outcomes and Measures: Standard observations of childcare practices, including a 20-item infant Safe Sleeping Guideline checklist. Educator characteristics, including each individual's knowledge, beliefs and attitudes regarding safe sleeping practices.

Results: 83% of childcare services were observed to be non-compliant on at least one of 20 target guidelines (median 2.5, Max = 7); 44% were observed placing infants prone/side and 67% used loose bedding, quilts, doonas/duvets, pillows, sheepskins or soft toys in cots. Services with younger infants in attendance were more likely to place infants to sleep prone/side. 71% of the childcare settings had a copy of current safe sleeping guidelines displayed either in or at entry to the infant sleep room.

Conclusion: Despite 25 years of public health messaging, non-compliance with safe sleeping guidelines was observed to be high in childcare services. Understanding of the reasons underlying non-compliance, particularly in contexts where legislative mandate and access to information regarding safe sleeping is high, is critical to informing on-going public health messaging and should be the focus of future studies.

Keywords: Sleep, Infant, Safe Sleeping, SIDS, SUDI, Childcare

INTRODUCTION

Despite the effectiveness of public health campaigns across the past 25 years, sleep-related deaths remain a major cause of death in infancy.[1,2] Across developed nations a population incidence of 0.19 to 1.01 per 1000 live births is reported.[3,4] Many of these deaths occur in situations in which people did not adhere to evidence-based recommendations for safe sleeping practice (non-compliance)[1] and, therefore, are potentially preventable.

Importantly, not all of these deaths occur in parental care settings.[5] Available evidence suggests that about a quarter of sleep-related deaths occur in out-of-home settings, including formal childcare services.[6,7] Given both the high use of childcare services for infants in developed nations[8] and the persistence of sleep-related deaths in these settings,[5–7] childcare services are identified as important sites for prevention and intervention. Yet, there are few studies of childcare, [9,10] and fewer still that have independently assessed compliance with safe sleeping guidelines.[11]

Evidence underpinning safe sleeping guidelines is strong and consistent, yet non-compliance persists.[4] International epidemiological studies identify a range of modifiable environmental factors that can prevent infant death.[1,5,12] Many of these modifications are equally applicable in childcare services as in the home, especially those most proximal to the sleep environment: supine positioning, appropriate bedding, removal of environmental hazards, supervision and exposure to smoking.[13] Other factors identified as risks (e.g. hazardous co-sleeping) or protections (e.g. breastfeeding) are less salient in the childcare context, although it is noted that childcare services are significant sites for public health promotion and parent education.[14] In home settings, there is evidence that many families do not follow safe sleeping guidelines, do not follow *all* guidelines, or do not follow them *all of the time*. [15–18] For example, placing a baby to sleep in a non-supine position (front or side placement) has been consistently shown as a significant risk factor for sleep related

infant death[1] and, since the 1990s, a key focus of related public health campaigns.[19] Non-compliance is highest among families living in circumstances of disadvantage [15] and from racially or culturally diverse backgrounds.[16] However, recent studies report that some degree of non-compliance occurs regardless of family culture or socio-economic status.[5,15] In licensed childcare services the obligation to follow health guidelines is often formalised in regulations. In the United States, regulations vary by State and are not always consistent with evidence-based safe sleeping guidelines.[20] Evidence of practices indicate that childcare providers do not necessarily follow safe sleeping recommendations, particularly in relation to supine positioning.[11] In Australia, the site of the current study, adherence to safe sleeping guidelines is embedded within national legislation.[21] However, the extent to which legislation and regulation translate to compliance in practice is unknown.

The current study of Australian licensed childcare services employs detailed in-situ observation to assess the prevalence of compliance with national safe sleeping guidelines for infants.

METHODS

Sampling Framework

Childcare services were those participating in the *Sleep in the Early Years Study* (ANZCTR Registration ID:12618001056280). A random stratification frame was applied to the selection of centre-based childcare services (see Supplementary Materials Figure 1). A three stage random stratification process was used; first selecting by broad geographical distance from the Brisbane city, second by sampling small local areas (SLA) of high (>30%), medium (>20%- 30%), and low (0-20%) developmental vulnerability using the Australian Early Development Census (AEDC) [22] and finally using a random number generator to select centres within SLAs. AEDC is completed by teachers at school entry (age 5 years) and includes vulnerability across physical, social, emotional, language and communication

domains. Within each service, observations were conducted in at least two rooms catering for infants and toddlers (0-36 month). Home-based childcare services were a convenience sample and were identified through licensed family-day-care schemes located within the same geographical area as centre-based services. The lead educator within each of the observed childcare rooms/homes completed self-report surveys.

Procedures

Full-day, in-situ standard observations were conducted by trained researchers between Jun 2016-Jun 2017. **Researchers had a minimum of a 4-year university degree and/or 2 years' experience conducting observations in childcare and were provided 2 full-days of observation protocol training prior to data collection.** Childcare educators were notified prior to the visit and were informed of the research purpose; to observe childcare practices, including sleep practices. **Educators were provided surveys at the commencement of the visit and were typically completed during staff lunch breaks.** To ensure comparability, observations commenced by 9am and ended by approximately 2:30pm. Extended observations protocols allowed for observation of non-sleep periods, sleep transitions, and practices used with infants across multiple sleep episodes. In centre-based services, researchers observed sleep practices from within the sleep room, or through the sleep room observation window. In home-based services, researchers observed practices within the sleep location (bedroom, living-room) or via a non-recordable vision and sound monitor (Sleep Easy® RA9022G) with the researcher located directly outside the sleep room. To account for the possibility that older infants may roll independently into a prone position, safe sleeping checklist items relating to infant placement were completed at the point in which educators placed children onto their cots. **Researchers were provided a measuring tape to measure the gap between the mattress and cot.** Any areas of non-compliance to safe sleeping guidelines were reported directly back to the educators at the end of the visit. Standard observation assessments of

childcare interaction and structural quality were conducted during sleep and non-sleep periods.

Measures

Sleeping Practices

The Sleep Observations Measure for Early Childhood Education and Care (SOME)[23] was used to assess sleep practices. The SOME is a multi-item in-situ observational tool used to collect detailed records of sleep environments, sleep practices and children's behavioural responses within childcare settings. The SOME has been previously used and validated with preschool aged childcare settings. The SOME was adapted within the present study to include an additional 20-item observational Safe Sleeping Guideline checklist (SSG) based on those contained within the *SIDS and Kids Safe Sleeping Checklist and Guidelines for Education and Care Services*, [24] current at the time of study commencement (Table 1). As childcare rooms/homes typically have a mix of infants and toddlers, only practices with infants (>12 months) in each service are observed using the SSG. Age of infants was confirmed with the educator prior to commencement.

Educator knowledge, beliefs and confidence

A 19-item measure of educator knowledge, beliefs and confidence regarding infant sleep was developed (Supplementary Table 1) modelled from that used by Pease.[15] 7-items assessed educator knowledge, 6-items assessed educator beliefs, and 4-items assessed educator confidence. Responses were rated on 5-point Likert scale from Strongly Agree to Strongly Disagree. Items were coded as an optimality index (range -2 through +2; higher score = greater knowledge, confidence, and guideline consistent beliefs, respectively).

Service Characteristics

Extensive measurement of the community, child, quality and educator characteristics was undertaken for each childcare service. *Community characteristics* were determined by

standard coding of geographical location using the Socio-Economic Indices for Areas (SEIFA[25]; scores are deciles, range=1 [lowest 10%] to 10 [highest 10%]) and AEDC (scores are % of children with one or more vulnerability)[22], respectively. *Child characteristics*, including number of infants (<12 months), age of youngest infant, and child:educator ratios were based on direct observation and cross-checked against daily class registers. *Childcare quality* was assessed via two standard observational tools; the Infant/Toddler Environment Rating Scale (ITERS; centre-based)[26], Family Child Care Environment Rating Scale (FDCRS; home-based)[27] and Arnette Caregiver Interaction Scale (CIS)[28]. Scores for the ITERS/FDCRS ranged from 1-7, and for the CIS from 0-4, with higher scores indicating higher quality. *Educator characteristics* were based on self-report and included age, gender, highest qualification, number of years/months working in current service, and number of years/months working in the childcare sector.

Statistical Methodology

Data was analysed using SPSS Version 24. Descriptive statistics (*n*, %, median, interquartile range [IQR]) were used to describe compliance. Correlation coefficients between the number of non-compliant items and beliefs, knowledge and confidence were examined. Exploratory analyses of community, service, child and educator characteristics were also conducted, focused on differences between services where infants were placed supine vs non-supine (prone/side). Chi-square and Mann-Whitney test of group differences were applied. Due to the small sample size an alpha level of $p < 0.10$ was used to identify characteristics that may warrant further investigation in larger studies. Effect sizes for non-parametric analyses (ES; Cohen's *d* [large $ES \geq 0.8$; medium $ES \geq 0.5$; small $ES \geq 0.2$]; phi [large $ES \geq 0.5$]) are shown.

Ethical Approval

Ethical approval was received for the project by the University Human Research Ethics Committee (approval number:1500001089). Informed written consent was provided by the (1) service provider, (2) director/coordinator, (3) educators and (4) families.

RESULTS

The sampling framework and response rates for the study are shown in Supplementary Figure 1. 18 (15 centre-based; 3 home-based) included infants (<12months; $N=49$ infants [$M=2.7$ infants/service; range=1-6]) at the time of observation and formed the focus of the current study. Self-report surveys were completed by 31 (72%; 30 female) lead educators working within observed rooms/homes. The median (IQR) start- and end-time for observations was 8:45am (8:40-8:50am) and 2:30pm (2:15-2:30pm), respectively. A single sleep-time was provided in 11 (61%) of the childcare settings, with the number of sleep-times ranging from 1-3 per day (median=1.5; IQR=1-2). Service and educator characteristics are shown in Table 2 and 3.

Of the 18 childcare settings, 16 (83%) did not comply with all safe sleeping guidelines. Median non-compliance to SSG was 2.5 items (IQR=1-6; Max=8). Educators placing infant/s to sleep in a prone/side position ($n=8$; 44%) and using loose bedding, quilts, doonas/duvets, pillows, sheepskins or soft toys ($n=12$; 67%) were the most common areas of non-compliance (Table 1). Apart from four items that related to the type and placement of mattresses, there was at least one example of non-compliance observed for every SSG item.

Despite the high non-compliance, 71% ($n=12$) of the childcare settings had a copy of current safe sleeping guidelines displayed either in or at entry to the infant sleep room (Table 2). Educators indicated high levels of confidence in their knowledge of and their service's compliance with current standards (median=2; IQR=1.3-2; Table 3), with between 81-90% agreements reported across individual confidence items (see Supplementary Table 1). Overall compliance with SSG was not significantly associated with educator confidence, knowledge, or beliefs (Spearman's

rho=0.06, -0.13, 0.06, respectively). Exploratory analysis found no differences in community or quality characteristics between settings that did and did not comply with supine placement of infants (Table 2). Settings where infants were placed prone/side to sleep, included significantly younger infants (median=6.5 months; IQR=4.0-7.8) than those in settings where all infants were placed supine (median=10 months; IQR=7.5-11).

DISCUSSION

About a quarter of sleep related infant deaths occur in out-of-home contexts, mostly in childcare settings.[5,6] At least some of these deaths occur in circumstances of non-compliance with current safe sleeping guidelines and, therefore, may be preventable. This study aimed to independently observe and document compliance with safe sleep guidelines in childcare settings. The strength of the study is in the application of detailed and continuous observations in a sample of licensed childcare services across the childcare day. This approach contrasts with prior studies that have relied on self-report [9] and spot-audit observation.[11] Our study was conducted within the Australian context where childcare services are subject to a national legislative requirement to comply with evidence-based safe sleeping guidelines.[21]

Despite the tight legislative and regulatory context, we found that 83% of licensed childcare services were non-compliant with at least one safe sleeping guideline. Almost half of the services were non-compliant with the requirement to place infants supine, arguably the most prominent focus in public health campaigns across over a quarter of a century.[19] Our findings suggest that while guidelines were available in the childcare services there was a failure in their uptake. In contrast to studies from the USA, our findings could not be explained by inconsistent regulation,[20] nor of availability of evidence-based guidelines or confidence in knowledge.[29] Availability of guidelines was universally high. All services were required to comply with safe sleeping guidelines and 70% had these guidelines displayed. Confidence in personal knowledge

of the safe sleeping guidelines and service compliance were also universally high. Taken together, there is a clear disjuncture between access to guidelines, personal confidence, and individual understanding, interpretation and enactment of the safe sleeping guidelines.

The emergent findings from this study direct attention to new investigations to understand the high levels of non-compliance in childcare settings, despite a context of strong and consistent regulation and availability of information. Our exploration of the factors distinguishing services compliant and non-compliant with the recommendation for supine positioning identified few indicators distinguishing groups. However, the smaller sample size limited statistical power for analysis. Consistent with recent recommendations for studies in the home environment,[33] our data indicate the imperative for larger and cross-national studies to disentangle explanations for non-compliance. Modelling on our methods, observations of practices throughout the day that allow for multiple sleep-times and direct observation of placement are recommended.

Advances beyond this study should include examination of the relationship dynamics between parent and educators in responding to safe sleeping guidelines. Our findings of a disjuncture between policy, confidence and practice within the current study raises the possibility that *risk salience* is an explanatory factor in non-compliance, consistent with other areas of public health messaging.[30,31] For example, parent non-compliance with recommended vaccination schedules has increased at a time where inexperience of the outcome (e.g. polio, pertussis, rubella) reduces the potency of risk.[30] Failure to comply with safe sleeping guidelines, like failure to follow scheduled immunization protocols, is likely viewed as a less potent risk in a context where few will have had a direct experience of such an outcome. In this context other risks take precedence. In the case of sleep practices within childcare services, one risk for educators is the possibility of conflict with parents who request non-compliant placement of their infant.[32]

There are several limitations beyond sample size that should be considered. First, our study was conducted in a single time-point and assessed compliance with Australian guidelines. We note that there are variations in guidelines across time and nations. Such variations identify safe sleeping as embedded within a cultural and social context that should be considered in understanding compliance. Second, as educators were informed of the target of the study (i.e. sleep practices) it is possible that social desirability may have influenced compliance, thus while extremely high in the current study, the rates observed may be an underestimate. Finally, observation in the current study were focused on compliance at service, and not individual child level. It was not possible to examine whether educators exhibit differential compliance based on individual child characteristics. Future studies should consider if individual infant characteristics, such as age, modify educator perception of risk and compliance.

Despite 25 years of public health messaging, non-compliance with safe sleeping guidelines was observed to be high in our sample of childcare services. Understanding of the reasons underlying non-compliance, particularly in contexts where legislative mandate and access to information regarding safe sleeping is high is critical to informing on-going public health messaging. Risk salience is identified as one potential area explaining non-compliance, warranting detailed investigation in future studies.

WHAT IS ALREADY KNOWN ON THIS TOPIC:

- Despite the effectiveness of public health campaigns across the past 25 years, sleep-related deaths remain a major cause of death in infancy.
- Approximately a quarter of sleep-related deaths in infancy occur outside the home, many in childcare settings.
- Evidence from reviews of regulations, self-reported practice and investigation of deaths in childcare indicate that services may not always comply with safe sleeping guidelines.

WHAT THIS STUDY ADDS:

- This study provides the first in-depth, independent in-situ observation of compliance with safe sleep guidelines in licensed childcare services.
- Under legislated requirement to follow safe sleeping guidelines, 83% of childcare services were directly observed as non-compliant; 44% placing infants prone/side.
- Risk salience is identified as a focus for explaining non-compliance and warrants investigation in future studies.

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Table 1. Childcare services (n[%]) observed as non-compliant across each Safe Sleeping Checklist item.

	Non-compliant (%)
1. No loose bedding, quilts, doonas, pillows, sheepskins or soft toys in the cot	12 (67%)
2. Every baby is placed on his/her back to sleep with head and face uncovered (no bonnet, hat, hooded clothing)	8 (44%)
3. Cot is made up with baby's feet positioned at the bottom of the cot	6 (33%)
4. There are safe sleeping posters and information displayed for parents	6 (33%)
5. Bed clothes are tucked securely so bedding is not loose or baby is placed in a safe sleeping bag. <i>If in Sleeping Bag: Bag must have a fitted neck and armholes and no hoods</i>	4 (22%)
6. Cords hanging from blinds, curtains, electrical appliances and mobiles are out of reach of child inside cot	3 (17%)
7. Heaters or electrical appliances and mobiles are well away from the cot to avoid risk of overheating	3 (17%)
8. No electric blankets used	3 (17%)
9. Mattress was produced after 2005 ^a	3 (17%)
10. Bouncinettes, rockers and prams are not used as a sleeping environment unsupervised and restraints are done up properly when in use	3 (17%)
11. Wrapping is not used when baby is able to roll over freely ^{b,c}	2 (11%)
12. Locking pin is firmly in place in bassinets/cots that rock whenever baby is unsupervised	1 (6%)
13. No bumpers are used in cot	1 (6%)
14. Baby Wrapping (3-4mths): If able to roll arms are left free ^{b,c}	1 (6%)
15. Baby is in a smoke free environment ^d	1 (6%)
16. <i>Portacots</i> : Mattress supplied with the cot is used.	1 (6%)
17. <i>Portacots</i> : Second mattress or additional padding is not placed under or over the mattress supplied.	0
18. Plastic packaging is removed from the mattress	0
19. Mattress is firm, clean, well fitted (gaps less than 20mm) and flat (not elevated or tilted)	0
20. Less than 20mm gap between mattress and cot sides and ends	0

Note. Total N=18 childcare services. ^aDate confirmed with Educator. ^bEducator asked to confirm age/ability to roll freely. ^cEducator confirmed that infant is also wrapped at home. ^dEducator took smoke break during observation, level of infant exposure to smoke is unclear.

Table 2. Group difference in services characteristics between services placing infants supine (compliant) versus prone (non-compliant).

	Total ^a (N=18)	Supine (compliant) (n=10)	Prone (non-compliant) (n=8)	<i>p</i> ^b	<i>Effect Size</i> ^f
Baby is placed on his/her back to sleep	8 (44%)	10 (100%)	0 (0%)		
Safe Sleeping Guidelines on display (Yes)	12 (71%)	6 (60%)	6 (86%)	.34 ^g	.28
Childcare Service Characteristics					
<i>Community (service area)</i>					
Childcare type [center-based]	15 (83%)	7 (70%)	8 (100%)	.22 ^g	.40
SEIFA (decile) ^c	7.0 (2.0-9.0)	8.0 (4.0-9.0)	6.0 (2.0-8.8)	.32	.52
AEDC (%) ^d	19.6 (16.0-27.5)	22.9 (16.4-28.6)	19.1 (15.9-24.3)	.46	.36
<i>Child (room/home)</i>					
Number of infants	2.0 (1.5-4.0)	2.0 (1.0-3.0)	3.5 (2.0-4.8)	.15	.76
Average age of infants (months)	8.8 (8.0-10.5)	10.3 (8.3-11.0)	8.42 (8.0-9.1)	.15	.76
Age of youngest infant (months)	8.0 (5.0-10.0)	10.0 (7.5-11.0)	6.5 (4.0-7.8)	.03*	1.2
Includes infants <6-months [Yes]	5 (29%)	1 (11%)	4 (50%)	.13 ^g	.43
Child:edu ratio (sleep-time)	3.5:1 (2.5:1-4.0:1)	3.5:1 (2.5:1-4.0:1)	3.3:1 (2.4:1-4.0:1)	1.0	.17
<i>Quality (room/home)</i>					
CIS ^e	3.4 (3.2-3.6)	3.4 (3.1-3.8)	3.3 (3.3-3.6)	.83	.11
ITERS/FDCRS ^e	4.5 (3.6-5.2)	4.4 (3.1-5.5)	4.7 (3.9-5.3)	.61	.08

Notes. ^aValues shown are *Medians (IQR)* or *n (%)*. ^b *p*-values for non-parametric Mann-Whitney tests, unless otherwise indicate. ^chigher score = higher social economic status. ^d% of children with developmental vulnerability. ^eRange = 1-7; higher score = higher observed quality. ^fEffect sizes (ES) are Cohen's *d* (ordinal) [large ES≥0.8; medium ES≥0.5; small ES≥0.2] or Phi (nominal) [large ES=>0.5]. ^gFisher's exact-test applied.

Table 3. Group difference in educator characteristics between services placing infants supine (compliant) versus prone (non-compliant).

	Total ^a (N=31)	Supine (compliant) (n=16)	Prone (non-compliant) (n=15)	<i>p</i> ^b	<i>Effect Size</i> ^c
Gender (F)	30 (97%)	15 (93%)	15 (100%)	.25 ^e	.18
Age (years)	35 (29-45)	37 (31-48)	29 (22-41)	.11	.46
Year of birth	1981 (1971-1987)	1979.5 (1969-1985)	1987 (1975-1994)	.13	.67
<i>Qualification level</i>					
Certificate	7 (23%)	3 (19%)	4 (27%)	.78 ^d	.13
Diploma	21 (68%)	11 (69%)	10 (67%)		
Degree	3 (9.7%)	2 (13%)	1 (7%)		
<i>Experience in childcare</i>					
Years in current service	3 (1-9)	3.5 (1-10)	3 (1-6.5)	.57	.21
Years in sector	10 (5-16)	11.5 (5.8-20.8)	6 (4-14.5)	.10	.62
<i>Safe Sleeping Index</i>					
Knowledge	0.6 (0.1-1.2)	0.9 (0.3-1.3)	0.4 (0.1-1)	.22	.19
Beliefs	0 (-.3-0.7)	0.3 (-0.2-0.3)	-0.3 (-0.4-0.5)	.40	.07
Confidence	2 (1.3-2)	2 (1.9-2)	2 (1.6-2)	.59	.41

Notes. ^aValues shown are *Medians (IQR)* or *n (%)*. ^b*p*-values for non-parametric Mann-Whitney tests, unless otherwise indicate. ^cEffect sizes (ES) are Cohen's *d* (ordinal) [large ES≥0.8; medium ES≥0.5; small ES≥0.2] or Phi (nominal) [large ES=>0.5]. ^dChi-squared test.

^eFisher's exact-test applied.